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**CROSS-REFERENCE TO RELATED APPLICATION**

x1) This application relates to U.S. Patent Application Serial Number 09/443102 filed on November 18, 1999 and assigned to the present assignee, and U.S. Patent Application Serial Number                      being filed on                      based on Japanese Application Serial No. 11-070623 filed on March 16, 1999 and assigned to the present assignee. The contents of those applications are incorporated herein by reference.

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## BACKGROUND OF THE INVENTION

The present invention relates to an inter-system cooperative system for implementing functional cooperation among a plurality of information systems, and a method  
15 therefor.

Heretofore, information systems corresponding to various kinds of business have been developed and put to practical use. In recent years, attempts for implementing a wide variety of services by making those existing information systems cooperate have been made.

FIG. 10 shows an example of conventional cooperation among information systems. A teller system 1001 is a system to be used when conducting various kinds of teller business in a teller shop. An accounting system 1002 is a system to be used in a bank when giving services

When connecting information systems and making them cooperative as heretofore described, individual coping has heretofore been conducted. In other words, information systems to be made cooperative are individually subjected to alteration (such as function addition) to become cooperative. However, there are a great variety of kinds of information systems, and the number of their connection combinations is also very large. In such a scheme that systems to be made cooperative are individually altered, the development is troublesome and rapid inexpensive diversification is difficult. Furthermore, if a system

When connecting information systems and making them cooperative as heretofore described, individual coping has heretofore been conducted. In other words, information systems to be made cooperative are individually subjected to alteration (such as function addition) to become cooperative. However, there are a great variety of kinds of information systems, and the number of their connection combinations is also very large. In such a scheme that systems to be made cooperative are individually altered, the development is troublesome and rapid inexpensive diversification is difficult. Furthermore, if a system

cooperating with a plurality of other systems, such as the accounting system 1002 of FIG. 10 is altered, then other systems are largely affected and it is also considered that coordination cannot be effected among systems.

5           In recent years, therefore, there has been  
proposed such a scheme that various information systems are  
connected to a system having functions of route control and  
message conversion and serving as a core and systems are  
made cooperative via the system serving as the core. Such a  
10 scheme is called hub and spoke, and the core portion is  
called hub. The configuration of the hub and spoke is  
disclosed in U.S. Patent No. 5,193,056, Boes as well.

FIG. 11 shows a connection example in the hub and spoke. A teller system 1102, an Internet banking system 1103, a call center system 1104, an investment trust system 1105, a CRM (customer relationship management) system 1106, an accounting system 1107, and so on are connected to a hub 1101. The teller system 1102, the Internet banking system 1103, the investment trust system 1105, and the accounting system 1107 are similar to the systems 1001 to 1004 described with reference to FIG. 10. The call center system 1104 is a system of a so-called call center in which, for example, a toll-free telephone call originated by a customer is received by an operator and the operator operates the terminal to conduct various kinds of business in response to a request from the customer. The CRM system 1106 is a system for managing relations with customers. For example, commodities purchased by each customer in the past are

stored in a DB (data base), and an optimum commodity is proposed according to the purchase situations. In this way, the CRM system 1106 is a management system for building one-to-one proper relations with each customer.

5 By connecting the systems 1102 to 1107 to the hub  
1101, they can cooperate with each other without being  
conscious of other systems. For example, a message used by  
the teller system 1102 to request another system to do  
business is first input to the hub 1101. The hub 1101  
10 passes a judgment on the opposite party system to which the  
message should be sent. The hub 1101 converts the message  
into a message having a protocol and a message form  
conforming to the opposite party system, and sends a  
resultant message to the opposite party. Since a difference  
15 between systems is thus absorbed by the hub 1101,  
cooperation becomes easy by connecting systems to the hub  
1101. When constructing a new service, cooperation of  
systems can be easily implemented by defining a processing  
procedure for making the systems cooperative in the hub,  
20 without conducting alterations on the systems (or with  
conducting slight alterations concerning the user interface  
on the systems).

For example, when an individual buys the investment trust commodity, typically there is needed such an operation that the individual withdraws money from the individual's saving account (withdraws money in the accounting system) and deposits the money in the investment trust system (sends the money to the investment trust system

5 Also when the configuration of the system and the pattern of the cooperation are to be altered, it can be coped with by altering the definition stored in the hub. Alteration of one system exerts little influence upon other systems.

## SUMMARY OF THE INVENTION

In order to achieve this object, a cooperative  
25 system includes a plurality of information systems and a hub  
system connected to the plurality of systems. The hub  
system receives a message from a first information system,  
determines necessity of message conversion and a kind of

5 The hub system may determine whether flow control  
determining a flow and destination of a message received  
from the first information system based on a class of the  
message should be conducted, and conduct flow control only  
when it has been determined that flow control should be  
10 conducted.

FIG. 1 is a schematic diagram of a "hub and spoke" system of an embodiment of the present invention;

FIG. 3 is a diagram showing a system configuration example of a hub;

FIGS. 5A, 5B and 5C are diagrams showing three paths;

25                   FIG. 7 is a processing flow diagram of a server  
side adapter which receives a message via a specific  
protocol direct connection path;

FIG. 8 is a processing flow diagram of a server

FIG. 9 is a diagram showing an example of a message given and received in the present embodiment;

FIG. 11 is a diagram showing a connection example in a conventional "hub and spoke";

FIG. 13 is a processing flow diagram for determining a path on the basis of an amount of money of deposit;

FIG. 15 is a processing flow diagram in the case where a path is determined on the basis of a connected system;

FIG. 17 is a processing flow diagram in the case where a path is determined on the basis of a user class.

### (1) System Summary

Hereafter, an embodiment of the present invention will be described by referring to drawing.

The hub 100 includes client side adapters 101, a service finder 102, a flow controller (or flow controllers) 103, and server side adapters 104. These components basically exchange messages with each other via a communication controller 105 which is formed according to CORBA (Common Object Request Broker Architecture) specifications, which provides a distributed object environment. The CORBA is the name of a distributed processing environment architecture advocated by Object Management Group. As a protocol according to the CORBA specifications used in the hub, IIOP (Internet inter-ORB protocol) is well known.

The client side adapters 101 are provided so as to be associated with respective client side systems. Each of the client side adapters 101 has functions of channel I/F



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Otherwise, one adapter may be associated with all systems.

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side adapter 101, the flow controller 103 controls the flow of messages, i.e., controls which server side adapter 104 the message should be transmitted to in which order. Such control may be accomplished by a plurality of flow  
5 controllers, each controller controlling a flow for one cooperative service.

## (2) Route of Message

FIG. 2 schematically shows an execution  
10 environment of the "hub and spoke" system. Out of the system summary of FIG. 1, FIG. 2 shows the software configuration of the hub 100 and data flow in more detail. In FIG. 2, the teller system 111 and a teller terminal 204 are connected to the hub 100 as client side systems. As  
15 server side systems, the accounting system 121 and the investment trust system 123 are connected to the hub 100. The teller terminal 204 is a so-called window terminal. The teller terminal 204 is a terminal for an operator to input various kinds of information at a teller window or a call  
20 center in response to a customer's request. Hubs 201 and 202 having different footholds are connected to the hub 100. A manager 210 conducts operation management, system configuration management, and log acquisition specification control on various components in the hub 100.

25 A message transmitted from the client side system 111 or 204 is transmitted to the server side system 121 or 123 via the hub 100. As message routes (paths), three paths are prepared in the hub 100. The three paths are a normal

path, an adapter direct connection path, and a specific protocol direct connection path.

The path to be used is determined by each adapter on the basis of the received message. A method for  
5 determining the path will be described later.

#### (2-A) Normal Path

The normal path will now be described. An adapter 101b is an adapter associated with the teller terminal 204.  
10 A message transmitted from the teller terminal 204 is received by the adapter 101b. The adapter 101b converts the protocol of the message to a protocol in the hub by using a protocol conversion function 231. The adapter 101b then inquires of the service finder 102 the destination of the  
15 message by utilizing a destination acquisition (destination inquiry) function 232. The service finder 102 manages configuration information of adapters 101a, 101b, 104a, and 104b, and the flow controller 103, and management information of a message destination system. In the case of  
20 the normal path, the service finder 102 orders transmission of the message to the flow controller 103. Upon receiving the message, the adapter 101b conducts message conversion by using a message conversion function 233 as occasion demands, and transmits the message to the flow controller 103 by  
25 using a intra-hub message transmission and reception function 234. In the case where the adapter 101b conducts message conversion, the adapter 101b utilizes a message conversion engine 241 and a code conversion engine 242 of a

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common service 240. As for processing conducted in the hub 100, the processing history is recorded as a log by using a log acquisition function 243.

Methods of the message conversion and the protocol  
5 conversion are described in US 5,187,787, Skeen et al., US  
5,257,369, Skeen et al., and US 5,557,798, Skeen et al.

According to the received message, the flow controller 103 accesses some server side systems one after another in accordance with a determined flow, and conducts processing according to the message. The flow controller 103 determines a server side system to be accessed by inquiring of the service finder 102 and utilizing its management information. The flow controller 103 first accesses the accounting system 121 and conducts predetermined processing (261), and then accesses the investment trust system 123 and conducts predetermined processing (262). In the access (261) to the accounting system 121, the flow controller 103 sends a predetermined message to the adapter 104a associated with the accounting system 121, and obtains an answer message therefor.

Thereafter, in the access (262) to the investment trust system 123, the flow controller 103 sends a predetermined message to the adapter 104b associated with the investment trust system 123, and obtains an answer message therefor.

25 The flow controller 103 processes the obtained answer message as occasion demands, and returns a resultant message to the original adapter 101b. The adapter 101b conducts necessary processing such as protocol conversion and message

conversion, and returns an answer message to the associated teller terminal 204.

The message transmitted from the flow controller 103 by the access processing (261) to the accounting system 121 is received by an intra-hub message transmission and reception function 274 of the adapter 104a associated with the accounting system 121. The adapter 104a converts the protocol of the message from the protocol in the hub to a protocol of the accounting system 205. As occasion demands, the adapter 104a then conducts message conversion by using a message conversion function 273. The adapter 104a then transmits the message to the accounting system 121. According to the received message, the accounting system 121 conducts predetermined business processing. The accounting system 121 then generates an answer message, and returns it to the adapter 104a. The adapter 104a receives the answer message, converts the protocol of the answer message to the protocol in the hub by using the protocol conversion function 271, and inquires of the service finder 102 the destination of the answer message by using a destination acquisition function 272. (The adapter 104a may store the message source information in the memory when receiving the message, and use the information as the answer message destination.) Here, the destination is the flow controller 103. As occasion demands, the adapter 104a conducts message conversion by using the message conversion function 273. By using the message transmission and reception function 274, the adapter 104a sends the answer message to the flow

A message transmitted by the processing of accessing the investment trust system 123 (262) is received by the adapter 104b associated with the investment trust system 123. Processing conducted in the adapter 104 is similar to that conducted in the adapter 104a, and consequently its description will be omitted.

As heretofore described, in the normal path, a message issued by a client side system is subjected in a client side adapter to required conversion such as protocol conversion, and delivered to the flow controller. In a predetermined flow, the flow controller accesses a server side system via a server side adapter, and advances business processing. Between the client side and server side adapters and the flow controller, message transmission and reception are conducted by using the protocol in the hub (according to the CORBA specifications).

The flow of control from the client to the server heretofore described is shown in FIG. 5A.

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The adapter direct connection path will now be described by referring to FIG. 2. In the above described normal path, the flow controller can conduct processing with a plurality of servers made cooperative. In the case where the flow control is not required, however, a message can be sent from a client side adapter directly to a server side adapter by using the adapter direct connection path, without

The adapter 101a is an adapter associated with the teller system 111. A message transmitted from the teller system 111 is received by the adapter 101a. The adapter 101a converts a protocol of the message to the protocol in the hub by using a protocol conversion function 221, and inquires of the service finder 102 the destination of the message by using a destination acquisition (destination inquiry) function 222. In the case of the adapter direct connection path, the service finder 102 returns indication of an adapter of a server side system to which the message should be directly sent, as the destination of the message. Here, the adapter 104a of the accounting system 121 is indicated as the destination. Upon receiving this, the adapter 101a conducts message conversion by using a message conversion function 223 as occasion demands, and sends the message to the adapter 104a associated with the accounting system 121 by using an intra-hub message transmission and reception function 224. Processing conducted in the adapter 104a is the same as that described with reference to the normal path. However, an answer message is returned from the adapter 104a directly to the adapter 101a. Arrows 291 and 292 of FIG. 2 show message flows on the adapter direct

connection path.

As heretofore described, on the adapter direct connection path, a message issued by a client side adapter is transmitted directly to a server side adapter, and the message is not passed through the flow controller 103. As compared with the normal path, therefore, the communication speed is fast and the response is also fast. On the above described adapter direct connection path, the client side adapter 101a converts the protocol of the client side system 111 to the protocol in the hub (according to the CORBA specifications), and the server side 104a converts the protocol in the hub to the protocol of the server side system 121. Instead of conducting such protocol conversion, the client side adapter 104a may convert the protocol of the client side system 111 to the protocol of the server side system 121, and send the message directly without intervention of the protocol in the hub. Since intervention of the protocol in the hub is thus obviated, communication can be conducted faster by that amount.

The flow of control from the client to the server heretofore described is shown in FIG. 5B.

#### (2-C) Specific Protocol Direct Connection Path

The specific protocol direct connection path will now be described by referring to FIG. 2. On the above described adapter direct connection path, protocol conversion is indispensable because the protocol of the client side is different from that of the server side. In



A message transmitted from the teller system 111 is received by the adapter 101a. The adapter 101a transmits the message directly to the adapter 104a. The adapter 104a receives the message. The adapter 104a transmits the received message to accounting system 121. An answer message is also returned via the specific protocol direct connection path in the same way.

As heretofore described, on the specific protocol  
20 direct connection path, a message issued by a client side  
adapter is transmitted directly to a server side adapter,  
and protocol conversion is not required. In other words,  
communication is not conducted by using intra-hub message  
transmission and reception functions 224 and 274 for  
25 exchanging messages according to the CORBA, but  
communication is conducted directly with the protocol used  
in the teller system 111 and the accounting system 121. As  
compared with the adapter direct connection path, therefore,

the communication speed is further faster and the response is also fast. By the way, message conversion may be conducted in either a client side adapter 101a or 101b, or a server side adapter 104a or 104b, as occasion demands.

5           The flow of control from the client to the server heretofore described is shown in FIG. 5C.

### (3) Determination of Path

          In (2), three paths have been described. A method  
10   for determining the path will now be described.

          FIG. 4 shows an example of adapter software. The client side adapters have the same configuration as the server side adapters. Each adapter is a function (program) mounted on an arbitrary computer included in the hub. Each  
15   adapter includes a program 404 and a table 407.

          The program 404 is divided into a protocol dependence section 405 and a protocol non-dependence section 406. The protocol dependence section 405 includes a message acceptance section 451, a path decision section 452, and a  
20   protocol conversion section 453. The protocol non-dependence section 406 includes a destination inquiry (destination acquisition) section 461, a message conversion section 462, and an intra-hub message transmission and reception section 463.

25           The message acceptance section 451 of the protocol dependence section 405 conducts acceptance processing of a message issued by the protocol of a client side or server side system associated with this adapter. According to the

accepted message, the path decision section 452 determines which of the normal path, the adapter direct connection path, and the specific protocol direct connection path should be utilized, on the basis of a path decision rule

5 471. The protocol conversion section 453 (corresponding to 221, 231, 271, and 281 of FIG. 2) conducts conversion between the protocol of the client side or server side system and the protocol of the CORBA specifications in the hub. The above described sections 451 to 453 are sections

10 which need processing depending on the protocol of a client side or server side system associated with this adapter.

The destination inquiry section 461 (corresponding to 222, 232, 272, and 282 of FIG. 2) of the protocol non-dependence section 406 conducts processing of inquiring of

15 the service finder the destination of a message. On the basis of a message conversion rule 472, the message conversion section 462 conducts conversion of the message form between a message form of a client side system and a message form of a client side system. Since the message

20 conversion can be conducted in an arbitrary position between the client and the server, it is sufficient that the message conversion section 462 is provided in either the client side adapters or the server side adapters. In some cases, the term "protocol" refers to not only the communication

25 procedure in a physical layer but also conversion of the message form between systems, as a whole. However, it is now assumed that the term "protocol" does not include conversion of the message form. The intra-hub message

transmission and reception section 463 conducts message  
transmission and reception according to the protocol of the  
CORBA specifications in the hub. The sections 461 to 463  
heretofore described are sections for conducting processing  
5 which does not depend upon the protocol of the client side  
or server side system associated with the adapter. The  
sections 461 to 463 are sections which operate on the CORBA.

The sections heretofore described correspond to  
the functions of FIGS. 5A to 5C.

10 FIG. 9 shows an example of a message given and  
received in the present embodiment. The message includes  
control information 901, a business code 902, and business  
specific information 903. The control information 901 is  
control information representing the source and destination  
15 of the message, message class, or data length and form. The  
business code 902 is code information representing what kind  
of business the message requests. The business specific  
information 903 is information specific to the requested  
business.

20 The control information 901 may include a path  
decision result conducted by the adapter and a flag  
indicating whether message conversion has already been  
conducted. (These kinds of information may be transmitted  
between programs in the hub by an internal protocol of the  
25 hub.)

FIG. 6 shows the processing flow of a client side  
adapter. Upon accepting a message from a client side system  
at step 601, the client side adapter acquires the class of

the message at step 602. At step 603, the client side adapter conducts a path decision and may write a result into a control information field of the message. At this time, the client side adapter may refer to the path decision rule 471 of FIG. 4. Subsequently, at step 604, the client side adapter determines whether the message is a message for specific protocol direct connection path. When the message is not a message for specific protocol direct connection path, the client side adapter converts its protocol to the protocol of the CORBA specifications which is being used in the hub at step 605, and inquires of the service finder the destination at step 606. Upon acquiring the destination from the service finder, the client side adapter transmits the message to its destination, i.e., to the flow controller or server side adapter at step 607, and finishes the processing. No matter whether the destination is a server side adapter of the adapter direct connection path or the flow controller of the normal path, processing except the destination remains unchanged in the client side adapter.

The client side adapter conducts only processing of transmitting the message to the destination acquired from the service finder. When it is determined that the message is a message for the specific protocol direct connection path at the step 604, the client side adapter transmits the message via the specific protocol direct connection path at step 608 and finishes the processing.

The path decision will now be described in detail by citing a plurality of examples.

In the processing flow of the client side adapter of FIG. 6, the path decision of the step 603 is conducted on the basis of the control information 901 and the business code 902 of FIG. 9. FIG. 12 shows an example of a processing flow of the path decision. At step 1201, the control information 901 and the business code 902 are read out from the message. At step 1202, it is determined whether the business code 902 is "investment trust application." If so, the normal path is selected as a decision result at step 1208. Otherwise, it is determined at step 1203 whether the business code 902 is "saving account deposit" or "saving account withdrawal." If neither of them is the case, then it is judged at step 1207 that the associated path has not been found. If the business code 902 is either "saving account deposit" or "saving account withdrawal," then it is determined at step 1204 whether the source and the destination have the same protocol. In the case of the same protocol, the specific protocol direct connection path is selected at step 1205. If the source and the destination do not have the same protocol, the adapter direct connection path is selected at step 1206.

Relations between business codes and paths may be defined in a table form as the path decision rule 471. Further, information representing protocols used by respective systems (source and destination) is also stored in the path decision rule.

As a variation of FIG. 12, an example in which a path is determined according to the source and content of a

Although it depends on a message and a system configuration handled by the system, there is a possibility that the load converges on a part of the system in the case of the specific protocol direct connection path and the adapter direct connection path. Therefore, the use of the specific protocol direct connection path and the adapter direct connection path can be limited to the special cases.

FIG. 13 shows a path decision flow depending on the amount of deposit money of a saving account. At step 1301, the control information 901 and the business code 902 are read out from the message. At step 1302, it is determined whether the business code 902 is "investment trust application". If so, the normal path is selected as a decision result at step 1312. Otherwise, it is determined at step 1303 whether the business code 902 is "saving account deposit". If so, then an amount of deposit money in

At the step 1305, the following additional service  
20 may be provided. If the amount of money is less than a  
predetermined value at the step 1305, then on the contrary  
the specific protocol direct connection is used to conduct a  
simple service. If the amount of money is at least the  
predetermined value, then the normal path is used to put an  
25 advertisement on the client side and/or access such a system  
as to activate a customer analysis system.



accesses an adapter. This method is effective to the case where it is desirable to conduct especially processing from a specific channel at high speed, such as a teller terminal. For example, it is possible to pass only processing from a specific channel through the specific protocol direct connection path, and pass the same request from other channels through the normal path. By doing so, the load of the specific protocol direct connection path can be lowered. As a result, processing on the specific protocol direct connection path can be executed at higher speed.

FIG. 14 shows an example of a table indicating paths of respective channels. A field of a system 1401 connected by the adapter indicates a channel which accesses the adapter. A field of a path 1402 indicates the path used to process a request from a channel indicated by the field 1401. For example, it is indicated that a request from an adapter for automated teller machine is processed via the specific protocol direct connection path. This table is stored as a part of the path decision rule.

FIG. 15 shows the processing flow in the case where the path to be used is changed according to the channel. At step 1501, the adapter reads out a path associated with a requested channel from the table shown in FIG. 14. For example, upon receiving a request from an automated teller machine, the adapter acquires a record corresponding to the automated teller machine from the field 1401 of the table of FIG. 14, and reads out a value of the path field 1402. At step 1502, it is determined whether the

value of the path 1402 indicates the specific protocol  
direct connection path. If so, the specific protocol direct  
connection path is selected at step 1508. If the path is  
not the specific protocol direct connection path, then it is  
5 determined at step 1503 whether the path is the adapter  
direct connection path. If so, the adapter direct  
connection path is selected at step 1507. If the path is  
not the adapter direct connection path, it is determined at  
step 1504 whether the path is the normal path. If so, the  
10 normal path is selected at step 1506. Otherwise, it is  
judged at step 1505 that the associated path has not been  
found.

Furthermore, by using user information in the path  
decision rule, processing from a specific customer can be  
15 processed at high speed. For example, only requests from  
excellent customers can be processed by using the specific  
protocol direct connection path. FIG. 16 shows an example  
of a table indicating association of user information with  
paths. A field of user information 1601 indicates user  
20 classes. For example, the user information field 1601  
indicates a class such as an own bank user, another bank  
user, or a large income earner. The path field 1602  
indicates a path to be used for each user class. For  
example, the own bank user can be set so as to use the  
25 specific protocol direct connection path. FIG. 17 shows a  
processing flow in the case where the path to be used is  
changed according to the user information. At step 1701,  
user information is read out from a message, and the user

class is judged. At step 1702, a path associated with the user class is read out from the table of FIG. 16. For example, if the user is an own bank user, then a record corresponding to the own bank user is acquired from the user information field 1601, and a value of the path field 1602 is read out. At step 1703, it is determined whether the value of the path field 1602 indicates the specific protocol direct connection path. If so, the specific protocol direct connection path is selected at step 1709. If the value of the path field 1602 does not indicate the specific protocol direct connection path, then it is determined at step 1704 whether the path is the adapter direct connection path. If so, the adapter direct connection path is selected at step 1708. If the path is not the adapter direct connection path, it is determined at step 1705 whether the path is the normal path. If so, the normal path is selected at step 1707. Otherwise, it is judged at step 1706 that the associated path has not been found.

The rule of such a path decision is set in the path decision rule 471 of FIG. 4 beforehand.

Processing of a server side adapter will now be described. By, for example, checking the control information 901 of a received message, the adapter can know the path via which the message has been transmitted.

FIG. 7 shows a processing flow of a server side adapter which receives a message via the specific protocol direct connection path. At step 701, a message is received. Namely, the message is received by the dependence section

(405 of FIG. 4) which conducts processing depending upon a specific protocol which is a protocol specific to a client or a server. At step 702, the dependence section transmits the message to a server side system by using the specific  
5 protocol. If an answer message representing a result of business processing is returned from the server side system, the answer message is received at step 703. At step 704, the dependence section returns the answer message to a client side adapter of the calling source. The processing  
10 is thus finished. FIG. 7 shows the case where message conversion is not conducted. When message conversion is required, however, the message conversion may be conducted in the processing of FIG. 7.

FIG. 8 shows a processing flow of a server side  
15 adapter which receives a message via the adapter direct connection path or the normal path. At step 801, a message is received. This is processing of receiving a message by using the protocol of the CORBA specifications which is being used in the hub. This is reception of a message  
20 conducted by the intra-hub message transmission and reception section 463 of the non-dependence section 406 shown in FIG. 4. Subsequently, at step 802, it is determined on the basis of the message class and the flag in the message whether message conversion is necessary. If  
25 necessary, the message conversion is conducted at step 803. Subsequently, at step 804, the message is delivered from the non-dependence section to the dependence section (405 of FIG. 4). At step 805, the dependence section converts the

protocol to a protocol specific to the server, and transmits the message to the server side system. If an answer message representing a result of business processing is returned from the server side system, the answer message is received at step 806. At step 807, the dependence section converts the answer message to a message having the protocol of the CORBA specifications in the hub. At step 808, the non-dependence section returns the answer message to a client side adapter of the calling source. The processing is thus finished. As for the answer message as well, the message conversion may be conducted as occasion demands.

### (3) Form of System

FIG. 3 shows a system configuration example of the hub in the present embodiment described with reference to FIGS. 1 and 2. Here, the hub is formed of three computers (hub servers) 301 to 303. Furthermore, servers and clients share the computers. (A server or client has a part of the hub function.)

On the hub servers 301 to 303, OSs (operating systems) 311, 321 and 331 and CORBAs 312, 322 and 332 are mounted. In the hub server 301, there are operating a client program 313, a client side adapter program 314, a server side adapter program 315, and a server program 316. In the hub server 302, there are operating a finder program 323, a flow control program 324, a server side adapter program 325, and a server program 326. In the hub server 303, there are operating a common service program 333, a

The client programs 313 and 335 are programs for implementing the client side systems described with

5 reference to FIGS. 1 and 2. The client side adapter  
programs 314 and 334 are programs for implementing the  
client side adapters described with reference to FIGS. 1 and  
2. The server side adapter programs 315 and 325 are  
programs for implementing the server side adapters described  
10 with reference to FIGS. 1 and 2. The server programs 316,  
326, and 336 are programs for implementing the server side  
systems described with reference to FIGS. 1 and 2. The  
finder program 323 is a program for implementing the finder  
described with reference to FIGS. 1 and 2. The flow control  
15 program 324 is a program for implementing the flow  
controller described with reference to FIGS. 1 and 2. The  
common service program 333 is a program for implementing the  
common service described with reference to FIG. 2.

These programs operate on an appropriate number of  
20 computers connected by a LAN (local area network). In the  
case where the hub is formed of a plurality of computers,  
arbitrary programs can be made to operate on each computer.  
Furthermore, each program can be distributed in function to  
a plurality of computers on CORBA. The client programs 313  
25 and 335 and the server programs 316, 326, and 336 are  
programs for conducting individual business processing, and  
they are not included in the hub. However, the clients and  
servers may be mounted on computers forming the hub.

As another example, the hub may be implemented by  
5 using one or more independent computers as shown in FIG. 1.

In any case, it is desirable to distribute the function of the hub so as not to concentrate the load on a part of computers and network lines.